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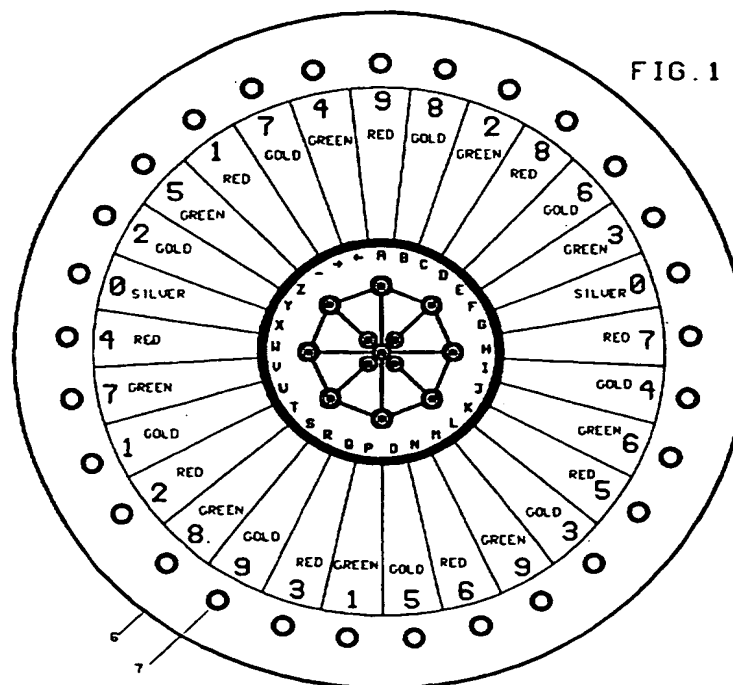
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(58) Field of Search

UK CL (Edition O) G1N NDPQ NDPX
INT CL⁶ A63F, H03K

(54) Player detection and location

(57) A system for detecting the movements of a player within the defined field of play of an amusement machine comprises a plurality of conductive sensors shown arranged as segments of a circle. In use, a loop antenna 6 radiates an electromagnetic signal which illuminates the field of play. Disturbances in the signal caused by the movements of a player are detected by the sensors.



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FIG. 1

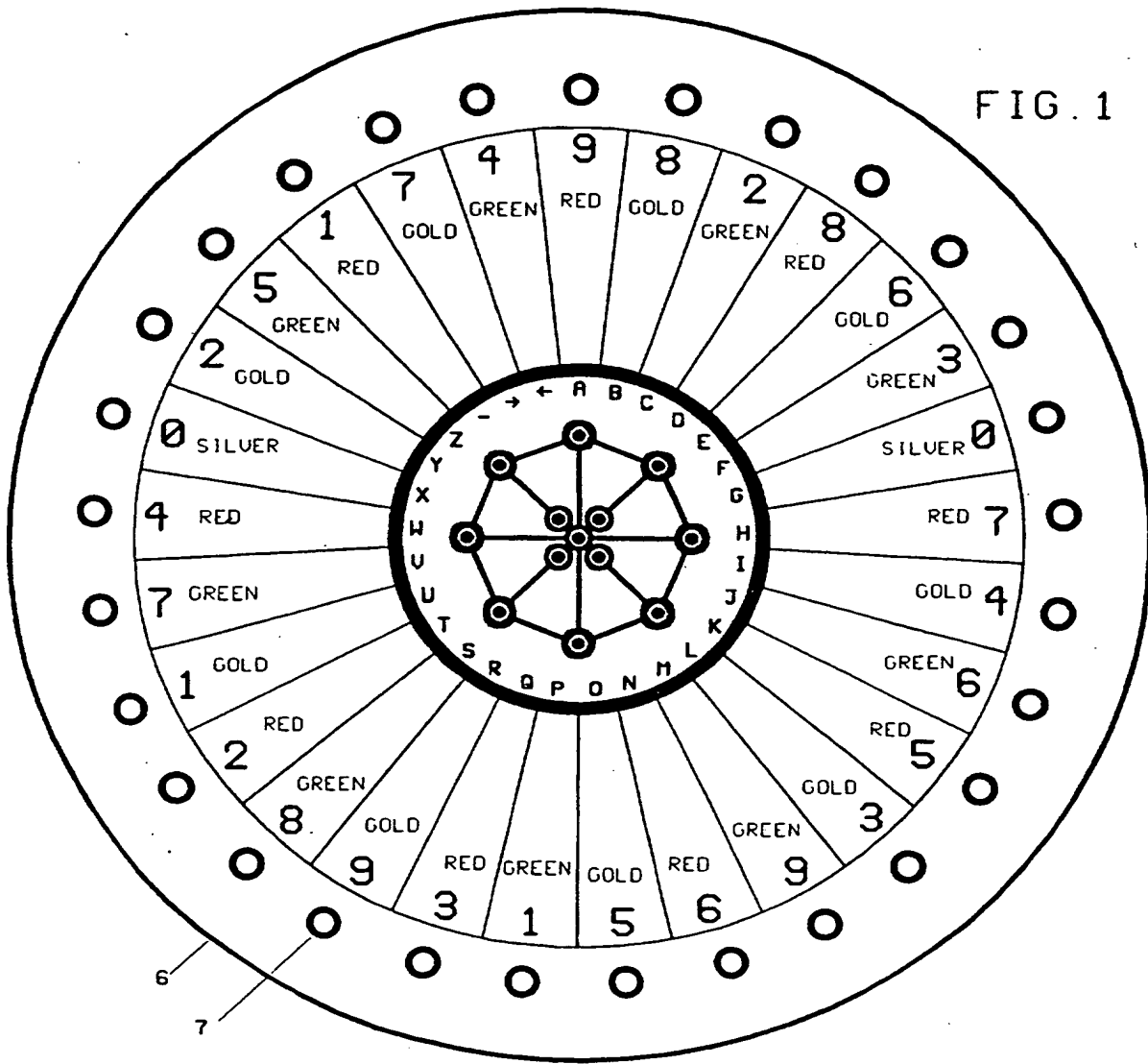
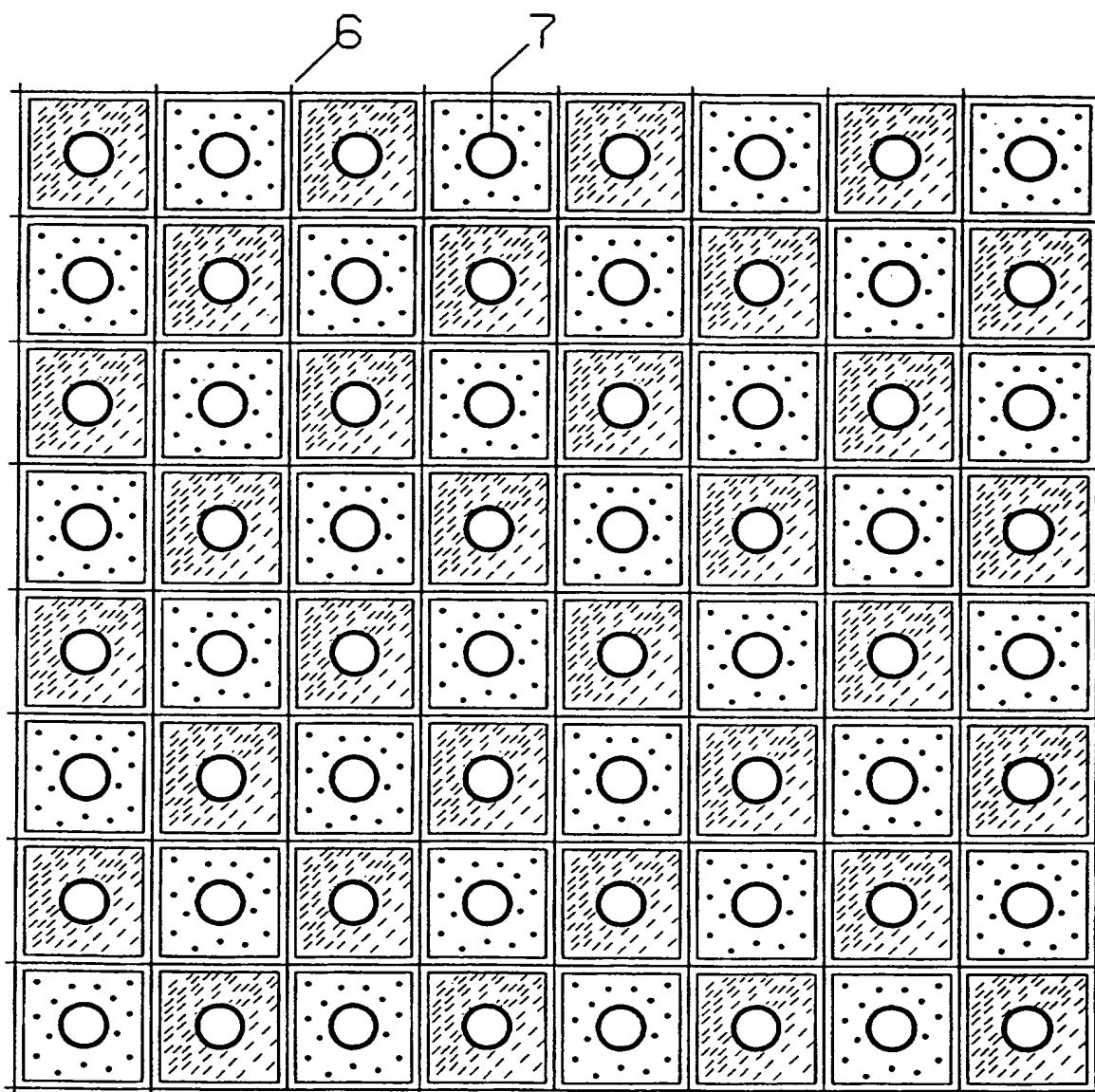


FIG. 2



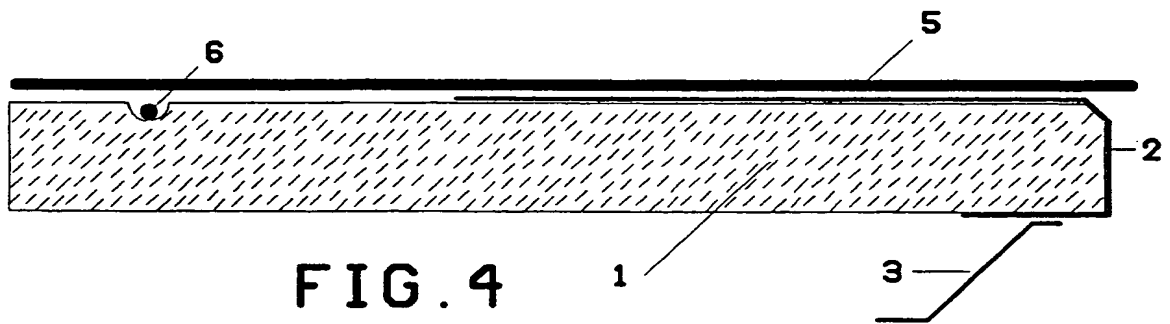
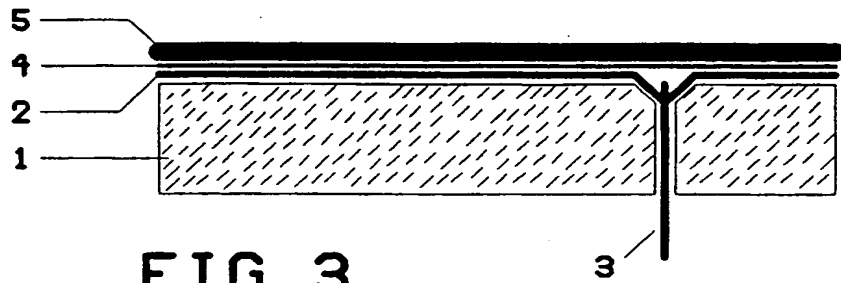


FIG. 5

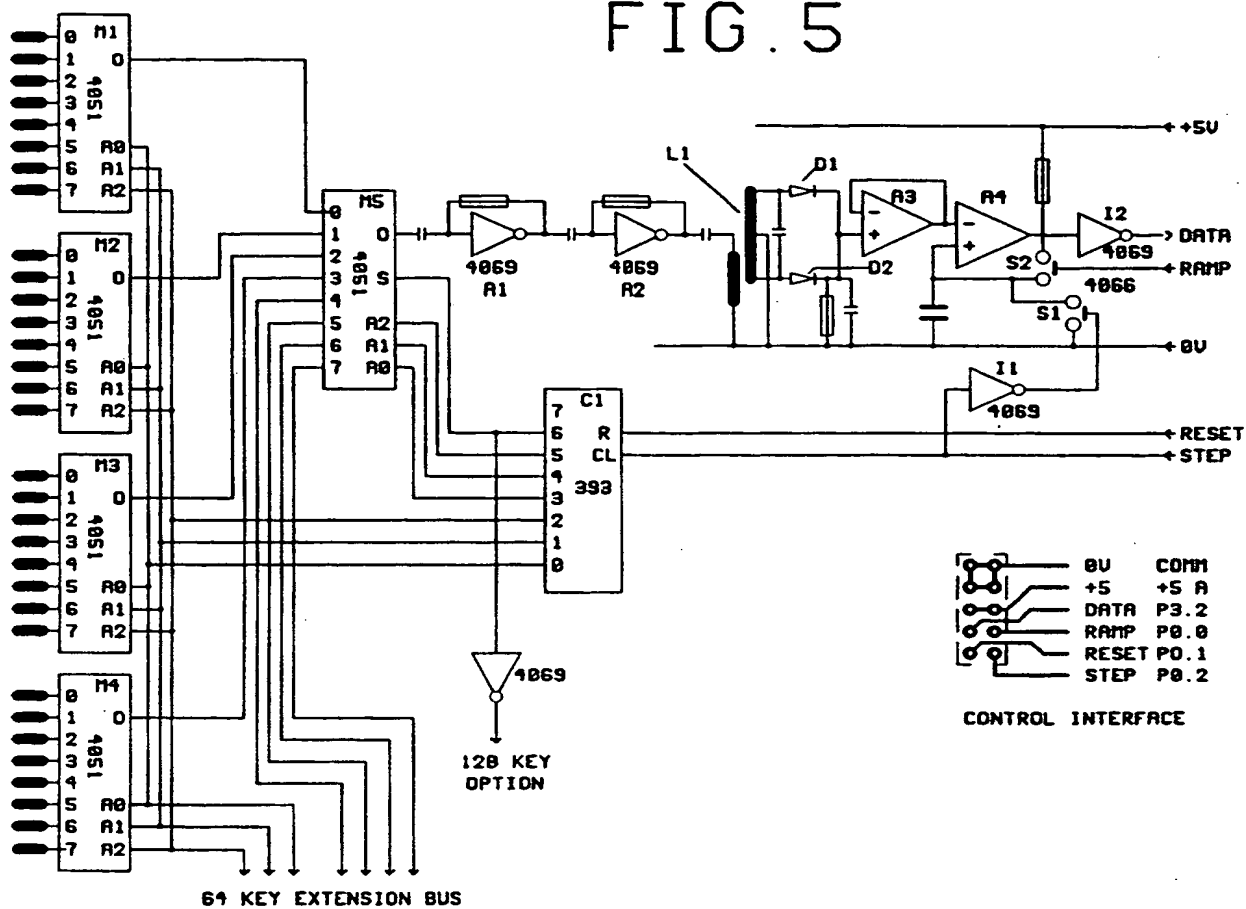
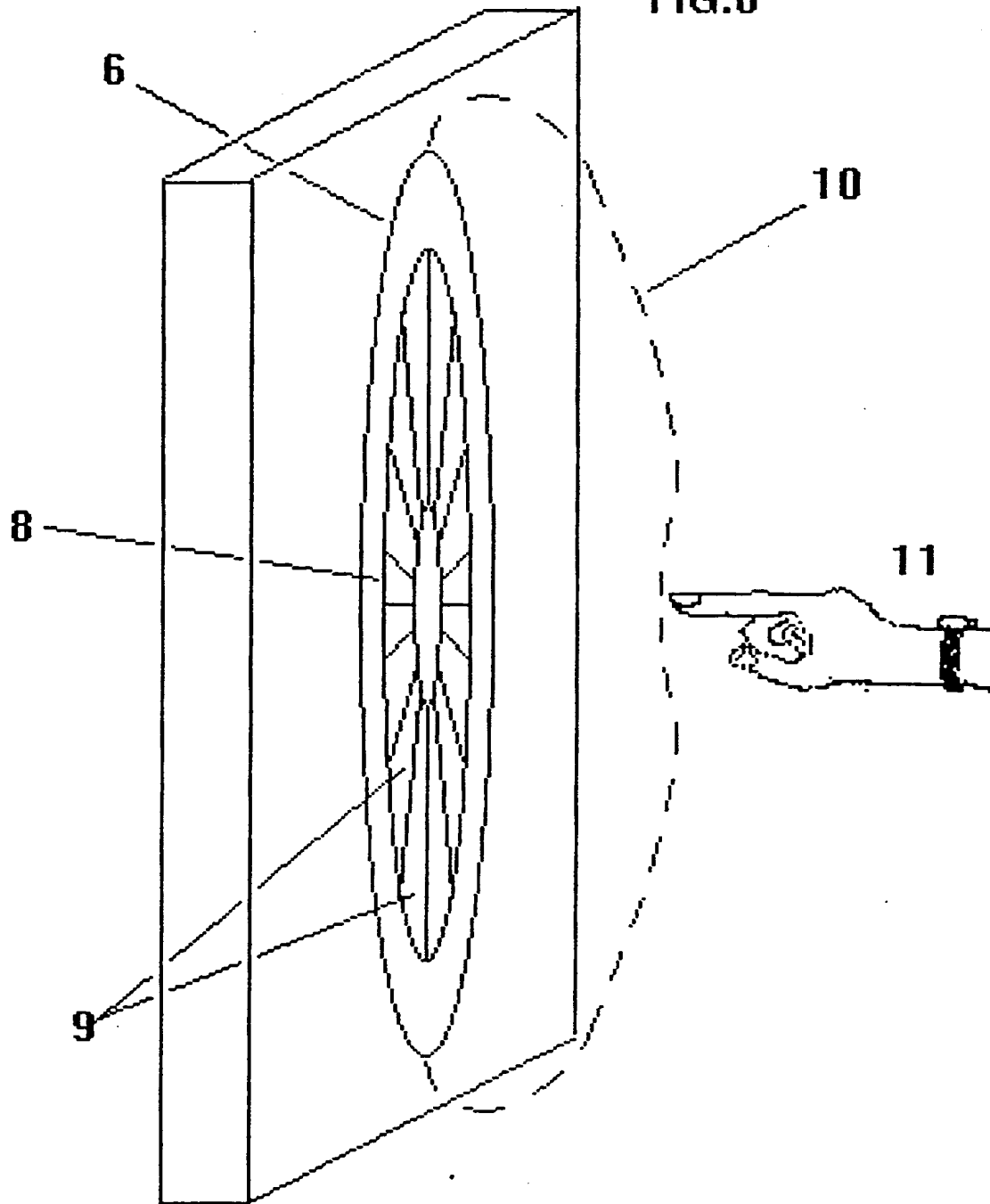


FIG.6



PLAYER DETECTION, LOCATION AND MONITORING**John Allen****TECHNICAL FIELD**

This invention relates to the electrically remote detection of a human player who places a hand or other part of the body within the defined field of an interactive amusement machine.

BACKGROUND

In the past, amusement machines which have required a player to make selections, nominate functions or more generally respond to the game play, and in particular, provide a touch sensitive response and/or detect movement and position without mechanical contact have relied upon a combination of mechanical switches, light beams or electrical conductivity.

These arrangements suffer from the disadvantages that the machine has to be complex and combine results from multiple sensor technologies, rendering truly accurate and stable functionality extremely difficult to achieve.

SUMMARY OF THE INVENTION

The main object of the present invention is to provide a single detection method which is able to:-

- a) Detect the presence and relative position of a hand or other part of the human body as it enters a defined field of view of an indicated sensitive area and:
- b) Detect and quantify movement and direction of movement within that field and:

c) Detect the physical touch of a member or electrically conductive artifact upon any of a number of delineated sub-areas of the sensitive area and:

d) Detect and quantify the relative amount of force which is applied to the delineated area by a player's finger and:

e) Provide a mechanism by which means, a player can be obliged to remove his or her hand entirely from the field between touches so as to enhance game play from the spectator's point of view. (This being of particular importance in the case of machines which are to be used for competitions between players or teams)

The sensitive area may be a flat or curved surface which may be divided into a suitable pattern of sub-target areas such as squares, hexagons or sectors, etc., each of which is comprised of a layer of conductive material which is separately connected to an electronic circuit. The sub-area or the whole area being covered by an insulating layer such as a clear polycarbonate sheet.

The sensitive area is illuminated by means of a high frequency electromagnetic signal.

BRIEF DESCRIPTION OF THE DRAWINGS

In the course of this description references will be made to the drawings in which:

Fig.1 shows an arrangement for a game which employs a plurality of responsive segments of four colours with the scores 1 to 9 repeated for each of three colours (red gold and green) and the score 0 for the remaining colour (silver) and with each segment provided with an illuminated indicator and the whole surrounded by a transmit antenna.

Fig.2 shows another arrangement for a game which employs a plurality of responsive rectangles and an interlaced transmit antenna but where no particular score is associated with any given target area.

Fig.3 shows a cross-section of a playing area as shown in fig.1 or Fig.2 and one preferred embodiment of a signal sensing arrangement.

Fig.4 shows a cross-section of a playing area as shown in Fig.1 or Fig.2 and a second preferred embodiment of a signal sensing arrangement as well as another preferred signal transmitting arrangement.

Fig.5 shows a suitable electronic circuit for receiving and processing the signals collected by the sensors indicated in fig.1 and fig.2.

Fig.6 shows how the machine and the player may interact with respect to a preferred layout.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention relates to the sensing of the presence, position and touch of a player relative to a responsive panel. As shown in the drawings, the panel may have a plurality of delineated areas each associated with a particular score, or a plurality of such areas not associated with particular scores but providing opportunity for strategic play.

Although only these two examples are described as suitable responsive areas, it is not intended that the present invention be so limited. It will be appreciated that the present invention may enjoy more widespread use

with many layout geometries and that the sub-areas may be accorded a variety of assignments. The sensitised playing area is also suitable for horizontal (table top) mounting.

In order to best describe the invention, a practical example of a game which employs all of the essential functions will be described. Referring to fig.6, an electromagnetic signal radiates from the transmit antenna (6) which illuminates the playing area (8) such that the sensors (9) pass a signal to electronic circuitry such as that described by Fig.5. When an object such as a human hand (11) enters the field (10), some of the energy is absorbed and the signal reaching the sensors (9) is reduced, with the greatest reduction being detected by the sensor closest to the hand. Thus, the machine is able to detect that the hand has entered the field and also, within the resolution provided by the number and disposition of the sensors and the computing ability of the circuitry, the relative position of entry. If the hand is moved across the sensors, its relative lateral movement can be tracked using conventional RADAR processing techniques and since as it is moved closer to the sensors, the signal continues to reduce, the distance from the playing surface may be similarly resolved.

As the hand makes contact with the plastic sheet (6) which covers the sensors, a significant relative rise in signal is detected on the sensor immediately beneath the finger, (further sharpened by the dielectric effect of the plastic), enabling the fact of contact to be established.

If a finger makes only light contact with the plastic sheet, the effected signal rise will be unambiguous but small, whilst the harder the finger is pressed upon the sheet, the greater will be the contact area and the

greater therefore will be the signal transfer, allowing the electronics to determine with a very high degree of accuracy and repeatability, the force with which the surface has been struck by any given finger at any given point on the surface.

Fig.1 shows one preferred playing assembly where 29 sensors arranged as segments of a circle, each with a unique colour / number combination but with the numbers 1 through 9 repeated for each of the colours red, gold and green and with 2 silver sectors having a value of zero. In this arrangement, peripheral lights (7) are employed in order to indicate sectors to the player and the signal is transmitted by a simple loop antenna (6) placed around and on the same plane as the playing area.

Fig.2 shows another preferred playing assembly where 64 sensors are arranged as a grid of squares of alternating design and / or colour, each with a single or multi colour light (7) placed at the centre and with a wire grid transmit antenna (6) arranged so as to surround each sensor.

Fig.3 shows one preferred sensor construction method where, (1) is a base-board of MDF or chipboard etc., (2) is a layer of conductive paint, (3) is a conductive wire which makes contact with the paint and provides connection to the electronic circuits, (4) is a layer of decorative material and (5) is a sheet of clear polycarbonate plastic or glass etc.

Fig.4 shows another preferred sensor construction where, (1) is a base-board of MDF or chipboard etc., (2) is a layer of conductive foil which is wrapped around to the rear of the board, (3) is a conductive spring contact which provides connection to the electronic circuits, (5) is a sheet of clear polycarbonate plastic or glass etc.

and, (6) shows a section of a suitable transmit antenna.

Fig.5 shows a suitable electronic circuit which, when connected to the sensors, is able to de-multiplex, amplify and rectify the received signals and by means of conventional comparator circuit, under the control of any suitable micro-controller, microprocessor or other such computing device, suitably condition the signals for further analysis. It will be appreciated that the comparator device functions as a part of a simple analogue to digital converter and could obviously be replaced by a composite item.

The drawing shows an arrangement for processing 32 sensors but the technique is no so limited and may be extended to any number of sensors, the limiting factor being the computational ability of the ensuing circuitry.

The multiple transmission gates (M1 through M4) individually steer the signals to the further transmission gate (M5) under the control of the 8 stage counter (C1). Each (high frequency AC) signal is then filtered and amplified by the (A1) and (A2) circuit and fed into a resonant L/C circuit formed around (L1) which is tuned to the transmitter frequency. (D1) and (D2) then provide full wave rectification, feeding the resultant DC signal via the buffer amplifier (A3), to a voltage comparator (A4). The other input to A4 is caused, under the control of a processor, to ramp from near zero volts (set by the "step" signal via the inverter (I1) and switch (S1)) towards the supply rail voltage, by means of the switch (S2) and resistor. When the ramp voltage exceeds the signal voltage, the comparator (A4) via the inverter (I2) sends a signal to the microprocessor. By measuring the time between closing the switch (S2) and the arrival of the said signal, the processor is able to quantify the magnitude of the signals emanating from the sensors. This

then provides the primary data for auto- and cross-correlating algorithms effected by the processor for the analysis of changes effected by the player.

I CLAIM

1. A system for detecting and locating the hand or other member of a human player or any conductive artifact which may be held by that player, with the said playing area, comprising:

a playing board having a face formed of a sheet of electrically non-conductive material covering a plurality of delineated electrically isolated, electrically conductive sections which function as sensors of an electromagnetic signal which is caused to illuminate the whole of the playing surface and surrounding area; and processing means, electrically connected to each of the sensors, said processing means distinguishing between a first electromagnetic signal which is received by each of the sensors in the absence of the proximity of a player and an altered set of signals which will prevail when a player's hand or other such electrically responsive artifact enters the field of illumination.

2. The system of claim 1, wherein the computing circuitry is further able to determine the player's movement upon a lateral plane with respect to the sensitised area.
3. The system of claim 1, wherein the computing circuitry is further able to determine the player's movements with respect to the distance from the sensitised area.
4. The system of claim 1, wherein the computing circuitry is further able to detect the physical touch of the player upon the surface of the sensitised area.
5. The system of claim 1, wherein the computing circuitry is further able to determine the relative force with which contact is effected by the player upon the surface of the sensitised area.

6. The system of claim 1, wherein the said processing means include a computer for distinguishing and interpreting the said signal changes.
7. The system of claim 1, wherein the electromagnetic signals emanate from a source remote from the said playing area.
8. The system of claim 1, wherein proximity or contact with the playing area is achieved by an artifact, such as a ball or a stick, held or thrown by the player.
9. The system of claim 1, wherein the described technology is incorporated into a machine with scoring indicators and other such displays and controls so as to form an amusement machine upon which can be played structured and competitive games.
10. The system of claim 9, wherein more than one person can play at the machine at the same time.
11. The system of claim 9, wherein a number of such machines may be electrically linked so as to enable multiple players to compete against each other at the same time.



Application No: GB 9608411.6
Claims searched: 1 to 11

Examiner: A J Oldershaw
Date of search: 22 August 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G1N NDPQ, NDPX

Int Cl (Ed.6): H03K; A63F

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB2286247A (M.I.T.)	1 at least
A	GB2230463A (KK ACE DENKEN)	
X	GB2094477A (WINSTON ELECTRONICS)	1 at least
X	EP0302727A2 (HILTCROFT PACKAGING)	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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